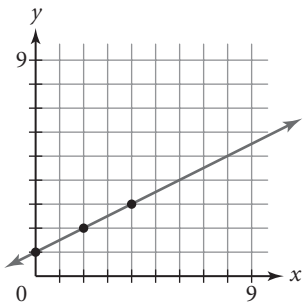
Chapter 4 • Quiz 1 — Form A

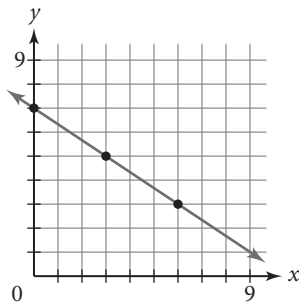
Name _____ Period _____ Date _____

1. Find the slope and the equation of each line.

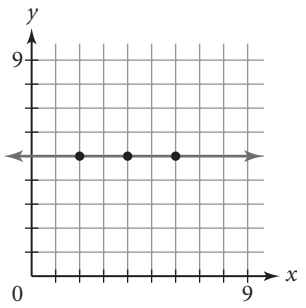
a.



b.



c.



2. Find the slope of the line through each pair of points, then name another point on the same line.

a. (2, 0) and (5, 6)

b. (5, −2) and (2, 3)

3. Students in Carlos's class collected data comparing each student's height with the distance between his or her elbow and wrist. The table shows the results for Carlos's group.

Elbow-to-wrist measurement (cm)	Height (cm)
61	160
66	166
70	172
73	178
77	183

a. Use your calculator to make a scatter plot of the (*elbow-to-wrist measurement, height*) data. Give the window values you used.

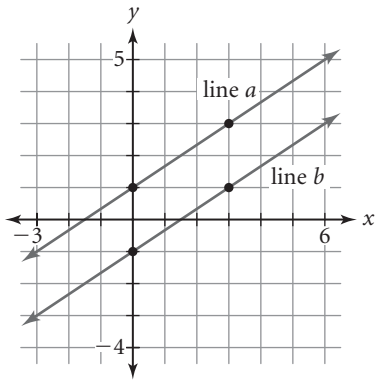
b. Find the slope of the line through the points (66, 166) and (73, 178). Explain the real-world meaning of the slope.

c. Use the slope you found in 3b to write an equation for the line in $y = bx$ form.

d. Graph your equation from 3c in the same window as the scatter plot. Explain why the line does not appear.

e. Change the equation to the form $y = a + bx$. Experiment with different values of a until you find a line that is a good fit for your data. Give the equation.

4. Two lines are shown on the graph.



a. Which of the lines matches the equation $y = -1 + \frac{2}{3}x$?

b. What is the equation of the line that does not match the equation in 4a?

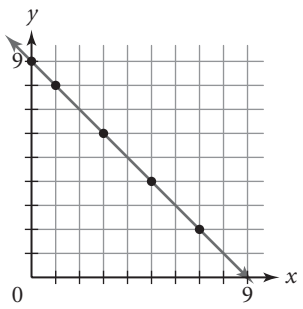
c. Describe the relationship between the two lines.

Chapter 4 • Quiz 1 — Form B

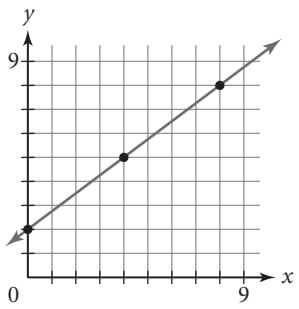
Name _____ Period _____ Date _____

1. Find the slope and equation of each line.

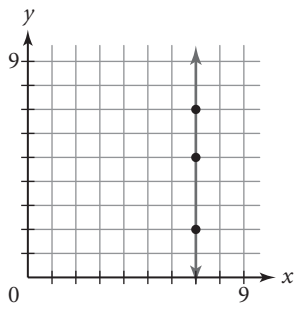
a.



b.



c.



2. Find the slope of the line through each pair of points, then name another point on the same line.

a. $(-2, 1)$ and $(5, -3)$

b. $(3, -5)$ and $(6, -5)$

3. Students in Carlos's class made a solar-powered cart as a class project. They tested the cart five times and made a table showing the time and distance traveled during each test run.

Time (s)	Distance (ft)
11.3	48
13.4	49
17.5	58
14.0	51
16.8	54

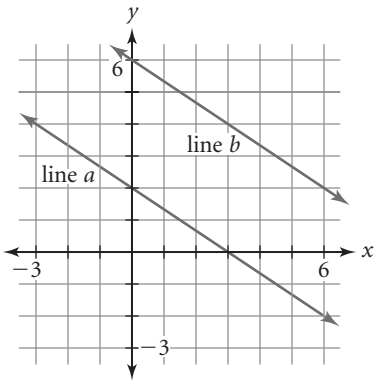
a. Use your calculator to make a scatter plot of the (*time*, *distance*) data. Give the window values.

b. Use the points (13.4, 49) and (16.8, 54) to calculate the slope of a line of fit. What is the real-world meaning of the slope?

c. Use your answer from 3b to graph an equation in the form $y = bx$ over your scatter plot. Explain why the line does not match your data (it may not show on your screen at all).

d. Change the equation to the form $y = a + bx$. Experiment with different values of a until you find a line that is a good fit for your data. Give the equation.

4. Two lines are shown on the graph.



a. Which of the lines matches the equation $y = 2 - \frac{2}{3}x$?

b. What is the equation of the line that does not match the equation in 4a?

c. Describe the relationship between the two lines.

Name _____ Period _____ Date _____

1. Write an equation in point-slope form for a line, given its slope and one point that it passes through.

a. Slope 6; $(-4, 3)$

b. Slope $-\frac{3}{7}$; $(5, -2)$

2. Write each equation in intercept form. For 2c, state the property you use for each step.

a. $y = \frac{5}{3} - \frac{1}{6}(x + 4)$

b. $-5x + 4y + 3 = 0$

c. $-4(y - 3) + 3(x - 1) = 8$

3. Write the equation of the line that goes through the points $(10, 8)$ and $(14, 6)$.

4. Solve each equation.

a. $8 + \frac{3x + 4}{4} = 10$

b. $5.2(x - 1.7) + 32.4 = 3.8$

Chapter 4 • Quiz 2 — Form B

Name _____ Period _____ Date _____

1. Write an equation in point-slope form for a line, given its slope and one point that it passes through.

a. Slope -4; $(2, -5)$

b. Slope $\frac{9}{5}$; $(-2, 7)$

2. Write each equation in intercept form. For 2c, identify the property you use in each step of the transition.

a. $y = -\frac{3}{2} + \frac{1}{4}(x + 3)$

b. $3x - 5y + 4 = 0$

c. $2(y - 3) - 5(x - 2) = 12$

3. Write the equation of the line that goes through $(10, 2)$ and $(7, 3)$ in point-slope form.

4. Solve each equation.

a. $\frac{2x - 6}{3} + 5 = 1$

b. $3.4 - 4.4(x + 1.8) = -16.4$

Chapter 4 • Quiz 3 — Form A

Name _____ Period _____ Date _____

1. The table lists the percentage of the U.S. population living in rural areas in the years given.

Year	Rural population (%)
1850	84.7
1870	74.3
1890	64.9
1910	54.3
1930	43.8
1950	36.0
1970	26.4
1990	24.8

(U.S. Census Bureau, *Encyclopedia Britannica Almanac 2005*, p. 763)

a. Use your calculator to make a scatter plot of the (*year, rural population*) data. Sketch the graph and describe the window you used.

b. Find the five-number summaries for the *year* data and the *rural population* data.

c. Add the quartile lines for the (*year, rural population*) data to your sketch. Give the coordinates of the two Q-points you should use for the line of fit.

d. Find the equation for the line of fit.

e. Write a sentence or two describing the real-world meaning of the slope of the line given by the equation in 1d.

f. Use your equation to estimate when 50% of the U.S. population lived in rural areas.

g. Use your equation to estimate the percentage of the population living in rural areas in 2000. How does your estimate compare to the actual percentage of 21.0%? What does the result tell you about using your equation to make estimates for recent years?

2. What is the main advantage of using Q-points to find a line of fit for a set of data?

Chapter 4 • Quiz 3 — Form B

Name _____ Period _____ Date _____

1. The table lists the winning times for the men's 100 m freestyle swim for Olympic games from 1952 through 2000.

Year	Winning time (s)
1952	57.4
1956	55.4
1960	55.2
1964	53.4
1968	52.2
1972	51.22
1976	49.99
1980	50.40
1984	49.80
1988	48.63
1992	49.02
1996	48.74
2000	48.30

(International Olympic Committee, *Encyclopedia Britannica Almanac 2005,* p. 947)

a. Use your calculator to make a scatter plot of the (*year, winning time*) data. Sketch the graph and name the window you used.

b. Find the five-number summaries for the *year* data and the *winning time* data.

c. Add the quartile lines for the (*year, winning time*) data to your sketch. Give the coordinates of the two Q-points you should use for the line of fit.

d. Find the equation for the line of fit.

e. Write a sentence or two describing the real-world meaning of the slope of the line given by the equation in 1d.

f. Use your equation to estimate when the winning time was 60 s.

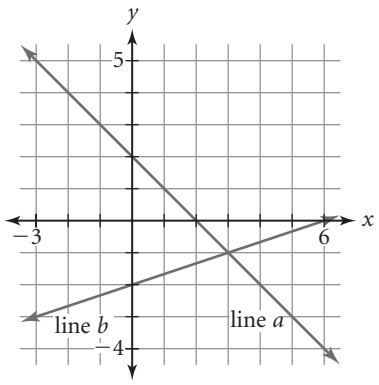
g. Use your equation to estimate the winning time in 2004. How does your estimate compare to the actual winning time of 48.17 s?

2. What is the main advantage of using Q-points to find a line of fit for a set of data?

Name _____ Period _____ Date _____

Answer each question and show all work clearly on a separate piece of paper.

1. Two lines are shown on the graph.



a. Give the slope, y-intercept, and equation for each line.

b. Name the point of intersection of the two lines.

2. The equation of a line, in point-slope form, is $y = 7 - 2(x - 5)$.

a. Name the point on the line with an x-coordinate of 3.

b. Name the point on the line with a y-coordinate of 5.

c. Use the point you named in 2b to write another equation of the line in point-slope form.

3. Explain how you can find the equation of a line when you know the coordinates of two points on the line.

4. Solve the equation $\frac{5 - 11}{x + 2} = 3$, using any method. Use another method to check your solution.

5. Write each equation in the form requested.

a. Write $y = 5x - 20$ in factored form so that the coefficient of x is $+1$.

b. Write $y = 14.7(x - 20) + 130.6$ in intercept form.

c. Write $y = 6.2x - 17$ in point-slope form, using the point with an x-coordinate of 8.

6. Name the property illustrated in each equation.

a. $6 \cdot 8 = 8 \cdot 6$

b. $6(8 + 4) = 6 \cdot 8 + 6 \cdot 4$

(continued)

Name _____ Period _____ Date _____

7. Jamie spent the summer in Canada. Because Canada uses the metric system, he wanted to be able to convert Fahrenheit temperatures to Celsius temperatures. He remembered from science class that the relationship between the two systems is linear. He also remembered that water freezes at 32°F, or 0°C, and boils at 212°F, or 100°C.

°F	°C
32	0
212	100

a. Show how Jamie could use this information to write an equation in point-slope form for converting Fahrenheit temperatures, *F*, to Celsius temperatures, *C*.

b. What is the real-world meaning of the slope of the line?

c. What is the Celsius equivalent of 68°F?

d. On a very warm day, the temperature was 40°C. What is the Fahrenheit equivalent of this temperature?

8. Isabel, a research assistant at Maryland State University Museum, measured the metacarpal I bone (the bone from the wrist to the thumb) and the height of ten human skeletons. Anthropologists can use data such as these to conjecture a person's height based on partial skeletal remains.

(Musgrave, Jonathan H., and Harneja, Narendra K., *American Journal of Physical Anthropology* (1978) vol. 48, pp. 113–120)

Metacarpal I length (mm)	45	50	39	41	52	47	50	42	46	43
Skeletal height (cm)	174	182	157	163	183	174	176	170	170	169

a. Use your calculator to make a scatter plot of the (*metacarpal I length, height*) data. Sketch the graph and describe the window you used.

b. Find the five-number summaries for the *metacarpal I length* data and the *height* data.

c. Give the coordinates of the two Q-points you should use for the line of fit.

d. Find the slope of the line through the Q-points. What is the real-world meaning of the slope?

e. Find the equation of the line through the Q-points.

f. Graph the equation from 8e in the same window as the scatter plot, and sketch the result. Do you think the line is a good model for the data? Explain why or why not.

Challenge Problem

For the data in Problem 8, find an equation that you think better represents the data. Explain the method you used.

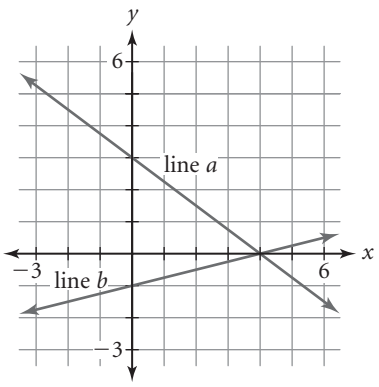
Chapter 4 • Test

Form B

Name _____ Period _____ Date _____

Answer each question and show all work clearly on a separate piece of paper.

1. Two lines are shown on the graph.



a. Give the slope, y-intercept, and equation for each line.

b. Name the point of intersection of the two lines.

2. The equation of a line, in point-slope form, is $y = 8 - 3(x + 3)$.

a. Name the point on the line with an x-coordinate of 2.

b. Name the point on the line with a y-coordinate of 11.

c. Use the point you named in 2b to write another equation of the line in point-slope form.

3. Explain how you can find the equation of a line when you know the y-intercept and the coordinates of one other point on the line.

4. Solve the equation $\frac{3x - 11}{5} + 6 = 8$, using any method. Use another method to check your solution.

5. Write each equation in the form requested.

a. Write $y = -22.5(x - 10) + 75.5$ in intercept form.

b. Write $y = -6x + 18$ in factored form so that the coefficient of x is $+1$.

c. Write $y = 7.2x - 2.4$ in point-slope form, using the point with an x-coordinate of 4.

6. Name the property illustrated in each equation.

a. $6(4 - 5) = 6 \cdot 4 - 6 \cdot 5$

b. $6 + (4 + 5) = (6 + 4) + 5$

(continued)

Name _____ Period _____ Date _____

7. Jamie spent the summer in Canada. Because Canada uses the metric system, he wanted to be able to convert Celsius temperatures to Fahrenheit temperatures. He remembered from science class that the relationship between the two systems is linear. He also remembered that water freezes at 0°C, or 32°F, and boils at 100°C, or 212°F.

°C	°F
0	32
100	212

a. Show how Jamie could use this information to write an equation for converting Celsius temperatures, *C,* to Fahrenheit temperatures, *F.*

b. What is the real-world meaning of the slope of the line?

c. What is the Fahrenheit equivalent of 25°C?

d. What is the Celsius equivalent of 59°F?

8. The table shows the gestation period and average longevity of several animals.

Animal	Gestation (days)	Average longevity (years)
Grizzly bear	225	25
Zebra	365	15
Red fox	52	7
Guinea pig	68	4
Horse	330	20
Rhesus monkey	166	15
Meadow mouse	21	3
Black rhinoceros	450	15
Sea lion	350	12
Sheep	154	12

(Fish and Wildlife Service, U.S. Dept. Interior, *World Almanac and Book of Facts 2005,* p. 180)

a. Use your calculator to make a scatter plot of the (*gestation, average longevity*) data. Sketch the graph and describe the window you used.

b. Find the five-number summaries for the *gestation* data and the *average longevity* data.

c. Give the coordinates of the two Q-points you should use for the line of fit.

d. Find the slope of the line through the Q-points. What is the real-world meaning of the slope?

e. Find the equation of the line through the Q-points.

f. Graph the equation from 8e in the same window as the scatter plot, and sketch the result. Do you think the line is a good model for the data? Explain why or why not.

Challenge Problem

For the data in Problem 8, use a different method to find a line that represents the data. Explain the method you used.

Chapter 4 • Constructive Assessment Options

Choose one or more of these items to replace part of the chapter test. Let students know that they will receive from 0 to 5 points for each item depending on the correctness and completeness of their answer.

1. *(Lesson 4.2)*
A line has an x-intercept of 12 and a y-intercept of 5.

a. Describe a real-world situation that can be modeled by the line.

b. Write an equation for the line in intercept form. Tell how the variables in your equation are related to the situation you described in part a.

c. Write a problem about the situation you described that can be solved by using your equation. Give a detailed solution to your problem.

2. *(Lesson 4.3)*
Describe completely what a line that satisfies the given conditions looks like. Then give an equation for a line that fits the conditions.

a. The line passes through Quadrants II, III, and IV.

b. The line has a negative slope and crosses the x-axis at 4.

c. The line passes through Quadrants I and II only.

d. The line passes through the origin and does not include any points where the x- and y-coordinates have the same sign.

3. *(Lesson 4.3)*
Consider the line that passes through the points $(-3, 7)$ and $(15, -2)$. Tell whether each statement is true or false and explain how you know.

a. An equation for the line is $y = 7 - 2(x + 3)$.

b. An equation for the line is $y = 3 - 0.5(x - 5)$.

c. The line does not pass through Quadrant I.

d. The y-intercept is 11, and the x-intercept is 5.5.

4. *(Lesson 4.3)*
A line passes through the points $(5, 12)$ and $(8, 33)$.

a. Describe a real-world situation that can be modeled by the line.

b. Use the two points to write an equation in point-slope form. Tell how the variables in your equation are related to the situation you described in part a.

c. Write a problem about the situation that can be solved by using your equation. Give a detailed solution to your problem.

(continued)

5. (*Lesson 4.4*)
For homework, Julia was given equations in point-slope form and had to rewrite them in intercept form. As shown, she made mistakes rewriting three equations. For each equation, explain what she did wrong and then give the correct series of steps.

a. $y = 4 - 3(x - 6)$
$y = 4 - 3x - 6$
$y = -3x - 2$

b. $y = -5 - (x + 8)$
$y = -5 - x + 8$
$y = 3 - x$

c. $y = 3 - 7(x + 1)$
$y = -4(x + 1)$
$y = -4x - 4$

6. *(Lessons 4.2 and 4.5–4.7)*
Use complete sentences to describe two methods for fitting a linear equation to data.

7. *(Lessons 4.2 and 4.5–4.7)*
The table shows the percentage of U.S. households that had cable television in the even-numbered years 1978 through 2002.

Year	Percentage	Year	Percentage
1978	17.9	1992	61.5
1980	22.6	1994	63.4
1982	35.0	1996	66.7
1984	43.7	1998	67.4
1986	48.1	2000	67.8
1988	53.8	2002	68.9
1990	59.0		

(Nielsen Media Research, *World Almanac and Book of Facts 2005*, p. 310)

a. Find a linear equation that fits the data. Describe the method you used and explain why you think your equation is a good fit.

b. Predict how the percentage of U.S. households with cable television will change over the next 10 to 15 years. Use your equation and the data to support your prediction.

8. *(Lessons 4.5–4.7)*
The table shows the world population in billions for even-numbered years from 1970 to 2004.

Year	Population (billions)	Year	Population (billions)
1970	3.707	1988	5.107
1972	3.862	1990	5.282
1974	4.013	1992	5.449
1976	4.158	1994	5.611
1978	4.302	1996	5.771
1980	4.453	1998	5.928
1982	4.608	2000	6.080
1984	4.770	2002	6.227
1986	4.935	2004	6.373

(*www.census.gov/ipc/www/worldpop.html*)

Tell whether each statement is true or false, and explain how you know.

a. The world population has been increasing by about 160 million people a year since 1970.

b. Using Q-points, a model for the data is $y = 0.082(x - 1978) + 4.302$, where x is the year and y is the world population in billions.

c. According to the Q-point model, 2000 was the first year the world population was 6 billion people or more.

d. The largest two-year increase in world population occurred between 1986 and 1988.

8. a. $y = 124 - 0.75x$

b. The slope, -0.75, means that 0.75 gal of water leaks out of the pool every minute. The y-intercept, 124, means that the pool contained 124 gal when it was filled.

c. In about 165 min

9. a. $a = -4$

b. $b = 18$

c. $c = 11.4$

CHAPTER 4 • Quiz 1 — Form A

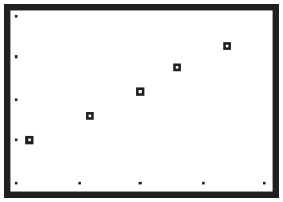
1. a. $\frac{1}{2}$; $y = 1 + \frac{1}{2}x$ **b.** $-\frac{2}{3}$; $y = 7 - \frac{2}{3}x$

c. 0; $y = 5$

2. a. The slope is 2. Answers will vary for the other point on the line. Two possible points are (3, 2) and (4, 4).

b. The slope is $-\frac{5}{3}$. Answers will vary for the other point on the line. Two possible points are $(-1, 8)$ and $(8, -7)$.

3. a. Windows will vary.



[60, 80, 5, 150, 190, 10]

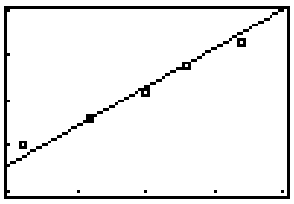
b. The slope is $\frac{12}{7}$. It is the increase in height for every increase of 1 cm in the elbow-to-wrist measurement.

c. $y = \frac{12}{7}x$

d. Explanations may vary. Sample explanation: Because of the a value (y-intercept) I chose, the line is not within my graphing window.

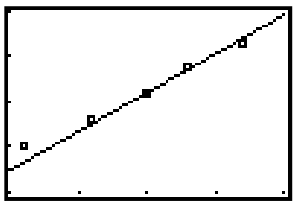
e. Answers will vary. Possible answers are

$y = 53 + \frac{12}{7}x$



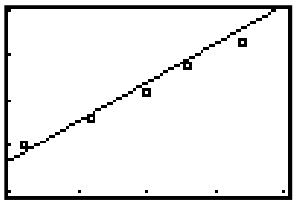
[60, 80, 5, 150, 190, 10]

$y = 52 + \frac{12}{7}x$



[60, 80, 5, 150, 190, 10]

$y = 54 + \frac{12}{7}x$



[60, 80, 5, 150, 190, 10]

4. a. Line b **b.** $y = 1 + \frac{2}{3}x$

c. They are parallel. (Students may say that they have the same slopes.)

CHAPTER 4 • Quiz 1 — Form B

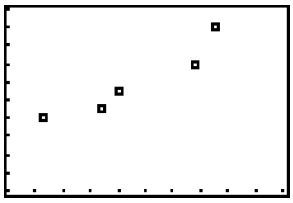
1. a. -1; $y = 9 - x$ **b.** $\frac{3}{4}$; $y = 2 + \frac{3}{4}x$

c. Undefined; $x = 7$

2. a. The slope is $-\frac{4}{7}$. Answers will vary for the other point on the line. Two possible points are $(-9, 5)$ and $(12, -7)$.

b. The slope is 0. Answers will vary for the other point on the line. A correct point will have a y-coordinate of -5.

3. a.



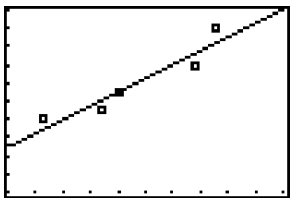
[10, 20, 1, 40, 60, 2]

b. $\frac{54-49}{16.8-13.4}=\frac{5}{3.4}\approx 1.5$. The slope is the increase in distance traveled for each 1 s increase in travel time. In other words, the slope is the speed measured in feet per second. According to this slope, the cart traveled approximately 1.5 ft/s. (Note that the slope was rounded to the tenths place to match the seconds data. Students may use 1.47.)

c. Explanations may vary. The line goes through (0, 0), so it is not within the graphing window.

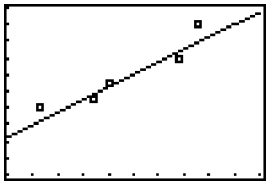
d. Answers will vary. Possible answers are

$y = 30 + 1.5x$



[10, 20, 1, 40, 60, 2]

$y = 29.5 + 1.5x$



[10, 20, 1, 40, 60, 2]

4. a. Line a **b.** $y = 6 - \frac{2}{3}x$

c. They are parallel (or they have the same slopes).

CHAPTER 4 • Quiz 2 — Form A

1. a. $y = 3 + 6(x + 4)$, or $6(x + 4) + 3$

b. $y = -2 - \frac{3}{7}(x - 5)$, or $y = -\frac{3}{7}(x - 5) - 2$

2. a. $y = 1 - \frac{1}{6}x$ **b.** $y = -\frac{3}{4} + \frac{5}{4}x$

c. The order of the properties may vary. Sample answer:

$-4(y - 3) + 3(x - 1) = 8$	Original equation.
$-4y + 12 + 3x - 3 = 8$	Distributive property.
$-4y + 3x + 12 - 3 = 8$	Commutative property.
$-4y + 3x + 9 = 8$	Combine like terms.
$-4y + 3x = -1$	Subtraction property.
$-4y = -1 - 3x$	Subtraction property.
$y = \frac{1}{4} + \frac{3}{4}x$	Division property.

3. $y = 8 - \frac{1}{2}(x - 10)$, or $y = 6 - \frac{1}{2}(x - 14)$

4. a. $x = \frac{4}{3}$ **b.** $x = -3.8$

CHAPTER 4 • Quiz 2 — Form B

1. a. $y = -5 - 4(x - 2)$ **b.** $y = 7 + \frac{9}{5}(x + 2)$

2. a. $y = -\frac{3}{4} + \frac{1}{4}x$ **b.** $y = \frac{4}{5} + \frac{3}{5}x$

c. The order of the properties may vary. Sample answer:

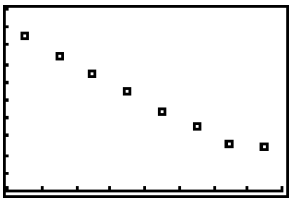
$2(y - 3) - 5(x - 2) = 12$	Original equation.
$2y - 6 - 5x + 10 = 12$	Distributive property.
$2y - 5x - 6 + 10 = 12$	Commutative property.
$2y - 5x + 4 = 12$	Simplify left side.
$2y - 5x = 8$	Subtraction property.
$2y = 8 + 5x$	Addition property.
$y = 4 + \frac{5}{2}x$	Division property.

3. $y = 3 - \frac{1}{3}(x - 7)$, or $y = 2 - \frac{1}{3}(x - 10)$

4. a. $x = -3$ **b.** $x = 2.7$

CHAPTER 4 • Quiz 3 — Form A

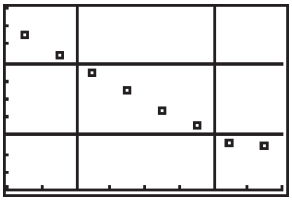
1. a.



[1840, 2000, 20, 0, 100, 10]

b. Five-number summary for the *year* data: 1850, 1880, 1920, 1960, 1990; five-number summary for the *rural population* data: 24.8, 31.2, 49.05, 69.6, 84.7

c. The lines are: $x = 1880$, $x = 1960$, $y = 31.2$, $y = 69.6$; The Q-points are: (1880, 69.6) and (1960, 31.2).



[1840, 2000, 20, 0, 100, 10]

d. $y = 31.2 - 0.48(x - 1960)$, or $y = 69.6 - 0.48(x - 1880)$

e. Descriptions will vary. Sample description: Every year between 1850 and 1990, the rural population percentage dropped at a rate of about 0.48% per year.

f. 1920 or 1921

g. $y = 31.2 - 0.48(x - 1960)$

$y = 31.2 - 0.48(2000 - 1960)$

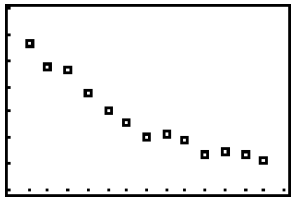
$y = 12$

According to the equation, 12% of the population should have been rural in 2000. This is much lower than the actual percentage. The model is not very good for years after 1980. (In 1990, the model would have predicted a rural population of 16.8% instead of the actual 24.8%.) In recent years, the percentage of the population in rural areas has not been declining as quickly as the model indicates.

2. With the Q-point method, everyone will find the same linear model. With the other methods, the model depends on the points chosen or a person's ability to judge whether a line is a good fit.

CHAPTER 4 • Quiz 3 — Form B

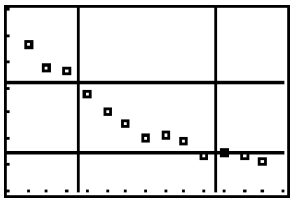
1. a.



[1948, 2004, 4, 46, 60, 2]

b. Five-number summary for the *year* data: 1952, 1962, 1976, 1990, 2000; five-number summary for the *winning time* data: 48.30, 48.88, 50.40, 54.3, 57.4

c. The lines are: $x = 1962$, $x = 1990$, $y = 48.88$, $y = 54.3$; the Q-points are (1962, 54.3) and (1990, 48.88).



[1948, 2004, 4, 46, 60, 2]

d. $y = 54.3 - 0.19(x - 1962)$, or $y = 48.88 - 0.19(x - 1990)$

e. Possible answer: The slope tells you that the winning time decreased at a rate of about 0.19 second per year (or 0.76 second per four years) from 1952 through 2000.

f. 1932

g. 46.32 or 46.22 (depending on the equation students use); this time is 1.85 or 1.95 s faster than the actual time.

2. With the Q-point method, everyone will find the same linear model. With the other methods, the model depends on the points chosen or a person's ability to judge whether a line is a good fit.

CHAPTER 4 • Test — Form A

1. a. Line a: slope, -1; y-intercept, 2; equation, $y = 2 - x$
Line b: slope, $\frac{1}{3}$; y-intercept, -2; equation, $y = -2 + \frac{1}{3}x$

b. The lines intersect at $(3, -1)$.

2. a. (3, 11)

b. (6, 5)

c. $y = 5 - 2(x - 6)$

3. First use the two points to find the slope, then use the point-slope form with either point to write the equation of the line.

4. Solution methods will vary; $x = -4$.

5. a. $y = 5(x - 4)$

b. $y = 14.7x - 163.4$

c. $y = 32.6 + 6.2(x - 8)$

6. a. Commutative property of multiplication

b. Distributive property

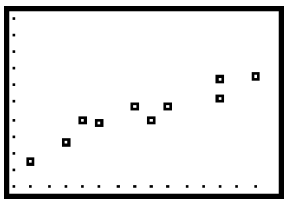
7. a. The slope is $\frac{100 - 0}{212 - 32} = \frac{100}{180} = \frac{5}{9}$. Using the point (32, 0), the equation is $C = \frac{5}{9}(F - 32)$. Using the point (212, 100), the equation is $C = 100 + \frac{5}{9}(F - 212)$.

b. The slope means that for every change of 1°F, there is a change of $\frac{5}{9}$°C.

c. 20°C

d. 104°F

8. a. Possible answer:



[38, 53, 1, 150, 200, 5]

b. The five-number summary for the *metacarpal I length* data is 39, 42, 45.5, 50, 52.
The five-number summary for the *height* data is 157, 169, 172, 176, 183.

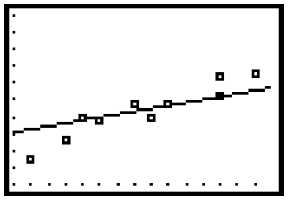
c. Q-points: (42, 169) and (50, 176)

d. The slope is $\frac{7}{8}$. This means that, generally speaking, the skeleton increases by 7 cm for every 8 mm of increase in metacarpal I length.

e. $y = 169 + \frac{7}{8}(x - 42)$ or

$y = 176 + \frac{7}{8}(x - 50)$

f.



[38, 53, 1, 150, 200, 5]

The Q-line is not a particularly good model for all the data. It fits the six data points in the middle, but not the two points at either extreme. If the line were adjusted to increase the slope slightly, it would be a better fit.

Challenge Problem

Answers will vary. Sample answer: Using the representative points (41, 163) and (52, 183), you get the line $y = 163 + \frac{20}{11}(x - 41)$, which seems to fit the data better.

CHAPTER 4 • Test — Form B

1. a. Line *a*: slope, $-\frac{3}{4}$; *y*-intercept, 3; equation, $y = 3 - \frac{3}{4}x$

Line *b*: slope, $\frac{1}{4}$; *y*-intercept, -1; equation, $y = -1 + \frac{1}{4}x$

b. The lines intersect at (4, 0).

2. a. (2, −7)

b. (−4, 11)

c. $y = 11 - 3(x + 4)$

3. Use the *y*-intercept and the point to find the slope of the line. Then use the slope and the *y*-intercept to write the equation in intercept or slope-intercept form, or use the slope and one of the points to write the equation in point-slope form.

4. Solution methods will vary; $x = 7$.

5. a. $y = -22.5x + 300.5$

b. $y = -6(x - 3)$

c. $y = 26.4 + 7.2(x - 4)$

6. a. Distributive property

b. Associative property of addition

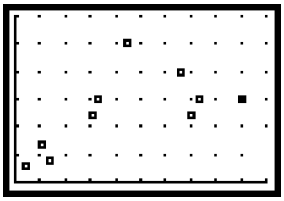
7. a. The slope is $\frac{212 - 32}{100 - 0} = \frac{180}{100} = \frac{9}{5}$. The *y*-intercept is 32, so the equation in intercept form is $F = \frac{9}{5}C + 32$. (Note: Students may also use the slope and one of the points to write an equation in point-slope form.)

b. The slope means that for every change of 1°C there is a change of $\frac{9}{5}$°F.

c. 77°F

d. 15°C

8. a. Possible answer:



[0, 500, 50, 0, 30, 5]

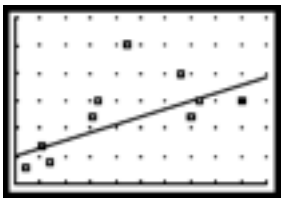
b. The five-number summary for the *gestation* data is 21, 68, 195.5, 350, 450; the five-number summary for the *average longevity* data is 3, 7, 13.5, 15, 25.

c. Q-points: (68, 7) and (350, 15)

d. The slope is about 0.028. For an increase of 1 day in gestation period, the average longevity increases by 0.028 year.

e. $y = 7 + 0.028(x - 68)$, or $y = 15 + 0.028(x - 350)$

f. The line is a fairly good fit, although the points below the line are closer to the line than the points above the line. You might move the line up slightly.



[0, 500, 50, 0, 30, 5]

Challenge Problem

Answers will vary. Sample answer: The line of fit is pretty good. Eyeballing, it looks like a better line would pass through (154, 12) with the same slope as the Q-point line: $y = 12 + 0.028(x - 154)$.

CHAPTER 4 • Constructive Assessment Options

Scoring Rubrics

1. 5 Points

a. The situation is realistic and fits the given criteria. Sample answer: Ryan rode his bike to school. He lives 5 mi from school, and the trip took him 12 min.

b. The equation is $y = 5 - \frac{5}{12}x$ (or $y = 5 - 0.41\overline{6}x$), and variables are correctly identified. For the situation described in part a, *x* is time in minutes and *y* is distance from school in miles.

c. The problem is clearly stated, and the solution is correct. Sample problem and solution are based on the situation in part a.

Problem: After how many minutes was Ryan 2 mi from school?

Solution: Solve $2 = 5 - \frac{5}{12}x$.

$2 = 5 - \frac{5}{12}x$	Original equation.
$-3 = -\frac{5}{12}x$	Subtract 5 from both sides.
$\frac{36}{5} = x$	Multiply both sides by $-\frac{12}{5}$.
$7.2 = x$	Divide.

Ryan was 2 mi from school after 7.2 min.

3 Points

a. The situation is realistic and fits the given criteria.

b. The equation is correct but is in the wrong form, or not all variables are correctly identified.

c. The problem is clearly stated, but the solution is unclear or is missing important steps.

1 Point

a. The situation does not fit one of the criteria.

b. The equation is correct (although it may be in the wrong form), but the variables are not identified, or the equation is incorrect, but the variables are correctly identified.

c. The problem is clearly stated, but no solution is given.

2. 5 Points

Descriptions are correct and thorough, and example equations fit the criteria.

a. Sample answer: The line has a negative slope and a negative y-intercept. Example: $y = -1 - 5x$

b. Sample answer: The line passes through Quadrants I, II, and IV. The y-intercept is positive. Example: $y = -3(x - 4)$

c. Sample answer: The line is horizontal and is above the x-axis. Example: $y = 2$

d. Sample answer: The line has a negative slope and passes through Quadrants II and IV only. Example: $y = -3x$

3 Points

One of the descriptions is incorrect, and one example equation is incorrect.

1 Point

Explanations are given, but most are incorrect or inadequate. Example equations are given, but most are not correct.

3. 5 Points

Answers are correct. Explanations are thorough and demonstrate an understanding of important concepts.

a. False. Possible explanation: The line with equation $y = 7 - 2(x + 3)$ has a slope of -2. The line through $(-3, 7)$ and $(15, -2)$ has a slope of $\frac{-2 - 7}{15 - (-3)}$, or -0.5.

b. True. Possible explanation: The equation for the line though $(-3, 7)$ and $(15, -2)$ is $y = 7 - 0.5(x + 3)$. If you rewrite this in intercept form, you get $y = 5.5 - 0.5x$. This is the same equation you get when you write $y = 3 - 0.5(x - 5)$ in intercept form, so the two original equations represent the same line.

c. False. Possible explanation: The line has a positive y-intercept and a negative slope (its equation is $y = 5.5 - 0.5x$), so it passes through every quadrant but Quadrant III.

d. False. Possible explanation: I found that the equation is $y = 5.5 - 0.5x$, so the y-intercept is 5.5, not 11. (And the x-intercept is 11, not 5.5.)

3 Points

At least three answers are correct. Explanations are well written, but a few minor details are missing or incorrect.

1 Point

Answers are correct, but no explanations are given. Or only one answer is correct, but it has a good, clear explanation.

4. 5 Points

a. The situation is realistic and fits the given criteria. Sample answer: Alisha saves the same amount of money each week. After 5 wk she has \$12, and after 8 wk she has \$33. Alisha is in debt to start.

b. The equation is given correctly as $y = 12 + 7(x - 5)$ or $y = 33 + 7(x - 8)$, and variables are correctly identified. For the situation described in part a, x is the number of weeks and y is the amount saved.

c. The problem is clearly stated, and the solution is correct. Sample problem and solution based on the situation in part a:

Problem: When will Alisha have \$100?

Solution: Solve $100 = 12 + 7(x - 5)$.

$100 = 12 + 7(x - 5)$	Original equation.
$88 = 7(x - 5)$	Subtract 12 from both sides.
$\frac{88}{7} = x - 5$	Divide both sides by 7.
$\frac{88}{7} + 5 = x$	Add 5 to both sides.
$17.6 \approx x$	Divide and add.

Alisha will have \$100 after 18 wk.

3 Points

a. The situation is realistic and fits the given criteria.

b. The equation is correct but is in the wrong form, or the equation is in the correct form, but the slope is incorrect due to a calculation error. Variables are correctly identified.

c. The problem is clearly stated, but the solution is unclear or is missing important steps.

1 Point

a. The situation is realistic but does not fit one of the criteria.

b. The equation is mostly correct (it may be in the wrong form or be incorrect due to minor calculation errors), but the variables are not identified, or the equation is incorrect, but the variables are correctly identified.

c. The problem is clearly stated, but no solution is given.

5. 5 Points

The mistakes are correctly explained, and the correct solution steps are given. (Students' explanations may vary slightly from those here.)

a. She did not distribute the -3 correctly; she multiplied -3 by x but not by -6.

$y = 4 - 3(x - 6)$

$y = 4 - 3x + 18$

$y = 22 - 3x$

b. She did not distribute the minus sign. To remove the parentheses, she should have multiplied -1 by x and by 8.

$y = -5 - (x + 8)$

$y = -5 - x - 8$

$y = -13 - x$

c. She did the subtraction before the multiplication. She should have started by using the distributive property to multiply -7 by $(x + 1)$.

$y = 3 - 7(x + 1)$

$y = 3 - 7x - 7$

$y = -4 - 7x$

3 Points

One of the mistakes is not explained clearly, and one set of solution steps contains a minor error.

1 Point

The mistakes are identified, but corrected solutions are not given, or the mistakes are not identified, but corrected solutions are given and are mostly correct.

6. 5 Points

The answer includes clear, correct descriptions of two equation-fitting methods. Possible descriptions of the methods students used in this chapter:

- Pick two points so the line through the points shows the overall direction of the data and there are about the same number of points on both sides of the line. Use the coordinates of the points to calculate the slope. Then use the slope to write an equation of the form $y = bx$. Estimate the y-intercept value, a, and write the equation $y = a + bx$, then graph all the points and the equation on a calculator and adjust the value of a until the line fits the data.
- Pick two points so the line through the points fits the data fairly well. Calculate the slope of the line through the points. Use the slope, b, and one of the two points (x_1, y_1) to write an equation in point-slope form, $y = y_1 + b(x - x_1)$.
- Use Q-points to fit the line. Find the five-number summary for the x-values and the five-number summary for the y-values. The Q-points are $(Q1_x, Q1_y)$, $(Q1_x, Q3_y)$, $(Q3_x, Q1_y)$, $(Q3_x, Q3_y)$, where $Q1_x$ and $Q3_x$ are the first and third quartiles of the x-values and $Q1_y$ and $Q3_y$ are the first and third quartiles of the y-values. Choose the two Q-points that show the direction of the data. Find the slope of the line through the chosen Q-points, and then use the slope and one of the points to write an equation in point-slope form.

3 Points

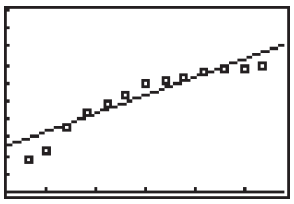
Two correct methods are described, but a few minor details are missing.

1 Point

One correct method is described, with some details missing, or two methods are described, but important details are missing.

7. 5 Points

a. The equation of the line and the data are correctly shown. The description of the method for finding the line is clear and correct. The explanation of how well the equation fits is clearly presented. Sample answer: I found the Q-line. I first found the Q-points. The quartiles of the *year* data are 1983 and 1997, and the quartiles of the *percentage* data are 39.35 and 67.05. Because the data values are increasing, the line of fit passes through the Q-points (1983, 39.35) and (1997, 67.05). The slope of the line through these points is $\frac{67.05 - 39.35}{1997 - 1983} = \frac{27.7}{14} \approx 1.98$. This slope and the point (1983, 39.35) give the equation $y = 39.35 + 1.98(x - 1983)$. I graphed the points and the equation.



[1976, 2004, 5, 0, 100, 10]

The line is a pretty good fit for most of the data, particularly from about 1982 to 1998. It shows the general direction of the data until about 2000. There are about the same number of points above as below the line.

b. The answer is clear and convincing and is based on the data and the graph. Sample answer: The equation indicates that the average percentage increase is about 1.98% each year. However, the data show that the rate of increase in the early years (from 1978 to 1982) was greater than 1.98%, and in the later years (since the mid-'90s) has been less. So I would predict that the model will not accurately predict the percentage of households using cable over the next 10 to 15 years. Over that period of time the percentage may go up, but I predict it will be by less than 1% a year, and in some years there may be a decrease.

3 Points

a. The equation fits the data reasonably well. The description of the method and explanation of why the line is a good fit are missing minor details. Sample answer: I got the equation $y = 67.4 + 2.025(x - 1998)$ by plotting the data and finding a line through two of the points. I graphed the points and the line on my calculator and could see that the line fits very well.

b. The prediction is reasonable, but it is not strongly tied to the data or the equation. Possible answer: I think the percentage will keep increasing because many people are getting digital cable and cable modems for their computers.

1 Point

a. A reasonable equation is given, but both the description of the method and the explanation of why the line fits are missing, or the equation, description, and explanation are given, but the line is not a good fit and the explanation of why it fits is not convincing. Sample answer: I got the equation $y = 43.7 + 1.7(x - 1984)$ by plotting the data and finding a line through two of the points. The line fits because it goes in the same direction as the points and contains two of the points.

b. The prediction is unreasonable and is not tied to the data or the equation. Possible answer: I think the percentage will start going down by a lot because more people are getting satellite dishes instead of cable.

8. 5 Points

Answers are correct. Explanations are thorough and demonstrate an understanding of important concepts.

a. False. Possible explanation: The population has increased by about 160 million people every 2 years, not every year.

b. True. Possible explanation: The appropriate Q-points are (1978, 4.302) and (1996, 5.771). The slope of the line through these points is about 0.082. Using the point (1978, 4.302), we get the equation $y = 0.082(x - 1978) + 4.302$.

c. False. Possible explanation: Substituting 1999 into the model gives a population value of 6.024 billion people, so 1999, not 2000, is the first year the population was 6 billion or greater.

d. False. Possible explanation: The change from 1986 to 1988 was 172 million people, but the change from 1988 to 1990 was 175 million people.

3 Points

At least three answers are correct. Explanations are well written, but a few minor details are missing or incorrect.

1 Point

Answers are correct, but no explanations are given, or only one answer is correct, but it has a good, clear explanation.

CHAPTER 5 • Quiz 1 — Form A

1. $x = 7, y = 5$

2. $x = 3, y = 1$

3. a. $s + j = 540$

b. $1.75s + 1.10j = 730.50$

c. 210 sandwiches and 330 juice boxes